Cruise Report

U.S. Geological Survey Cruise Report 2018-615-FA

February 26 – March 5, 2018

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USGS

Summary

During February 26 – March 5, 2018, the Pacific Coastal and Marine Science Center of the U.S. Geological Survey (USGS) conducted a survey collecting bathymetry data offshore of the Santa Cruz County shoreline, from Point Santa Cruz to the Moss Landing Harbor jetty. The work was conducted using personal water craft (PWC) out of the Santa Cruz and Moss Landing harbors. This survey is part of a series designed to document changes in shoreline position and coastal morphology in northern Monterey Bay related to episodic, seasonal and interannual processes.

The majority of the California coastline is actively eroding and major storms (El Niño) have caused significant shoreline retreat and property damage. During the next 100 years sea level is projected to rise ~1 m in California (NRC, 2012), making it increasingly important to understand the complex sediment transport and sedimentation patterns that control beach mophodynamics. The West Coast of the United States is among the least understood of the coastal environments, because high wave energy has limited the use of traditional monitoring methods used to study processes controlling sediment transport. The Santa Cruz Littoral Cell has a wide range of coastal morphologic settings, wave exposure, river influences, levels of coastal development and flooding vulnerabilities, making it an excellent opportunity to understand how different sites respond on storm and interannual time scales. This research project has received authorization through the Monterey Bay National Marine Sanctuary under permit **MBNMS-2017-010** and the California Department of Parks and Recreation.

The USGS research 2018-615-FA took place from February 26 – March 5, 2018. All operations took place during daylight hours between 07:39 AM and 3:24 PM Pacific Standard Time (PST). Bathymetric mapping was conducted using two PWCs, each equipped with a 200 kHz single beam echosounder and a GPS receiver. In accordance with the MBNMS permit, the vessels launched from either Santa Cruz or Moss Landing harbor and transited directly to the survey sites from Point Santa Cruz (Figure 1) to Moss Landing Harbor (Figure 2) and operated at speeds at, or less than, 4 knots once at the survey site. Fueling occurred prior to launching the vessels and did not land on the shoreline. Prior to operation, the U.S. Coast Guard and two MBNMS points of contact were notified of the plan and purpose for the survey. Figures 1 & 2 show the location of the survey track lines, with track line time and starting and ending locations listed in Table 1. Weather observations are provided in Appendix A and marine wildlife observations are provided in Appendix B. Exhibit H is provided in Appendix C.

References

National Research Council, 2012. Sea-Level Rise for the Coastal of California, Oregon, and Washington: Past, Present, and Future. Washington, DC: The National Academies Press.

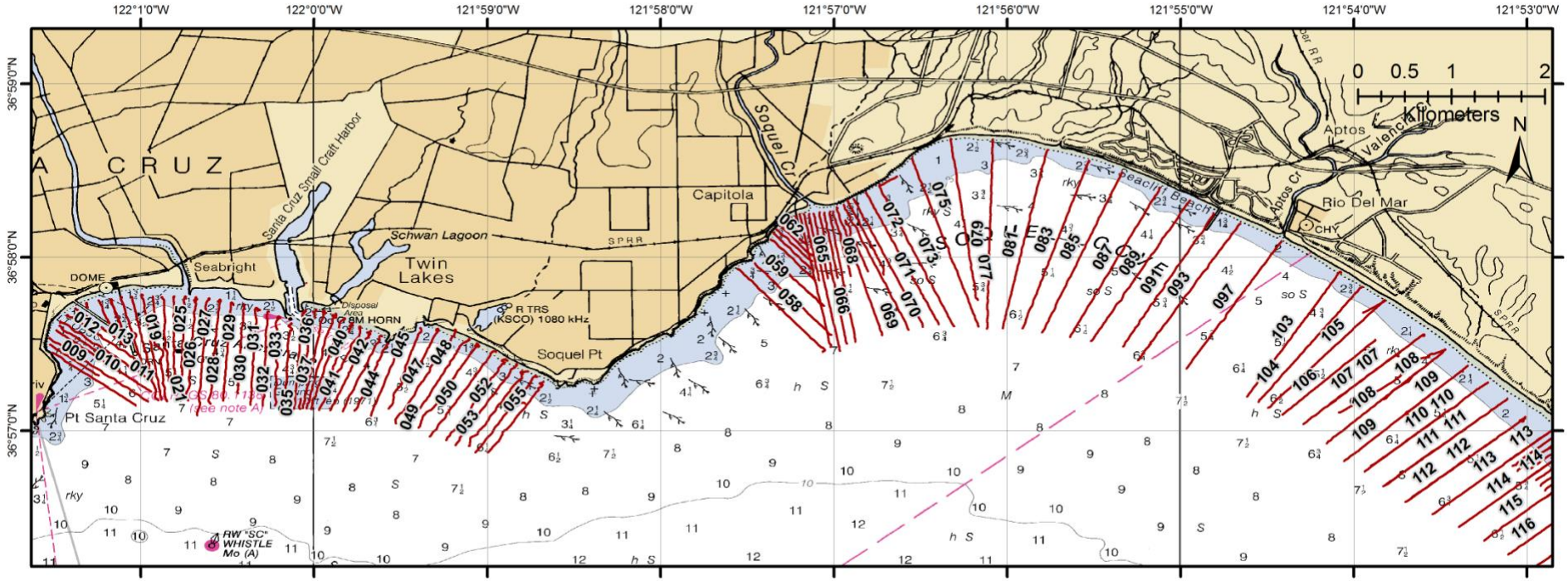

Figure 1. Northern extent of bathymetric data locations collected from February 26 – March 5, 2018 offshore of Santa Cruz County. Map projection is UTM Zone 10, meters.

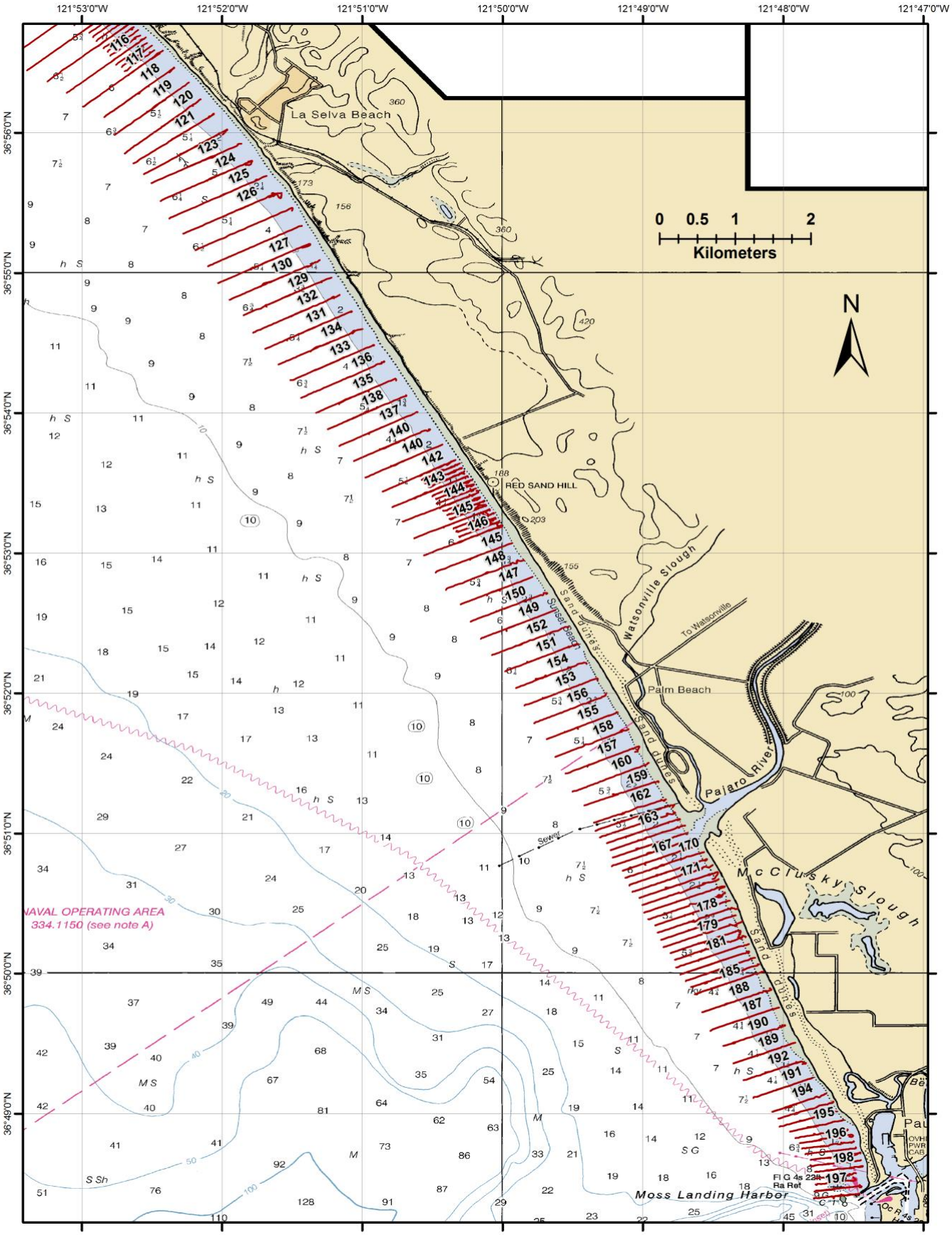

Figure 2. Southern extent of bathymetric data locations collected from February 26 – March 5, 2018 offshore of Santa Cruz County. Map projection is UTM Zone 10, meters.

Table 1. Survey track information.

Line #	Date	Start Time (PST)	Starting Latitude	Starting Longitude	End Time (PST)	Ending Latitude	Ending Longitude
110_0849.RAW	2/26/2018	8:49 AM	36.946653	-121.898345	8:56 AM	36.95464	-121.887082
111_0859.RAW	2/26/2018	8:59 AM	36.953099	-121.885237	9:06 AM	36.94478	-121.896984
112_0907.RAW	2/26/2018	9:07 AM	36.943167	-121.89504	9:15 AM	36.95134	-121.883487
113_0927.RAW	2/26/2018	9:27 AM	36.947223	-121.885022	9:30 AM	36.94977	-121.881368
113_1.RAW	2/26/2018	9:31 AM	36.946631	-121.884734	9:34 AM	36.9494	-121.880676
113_2.RAW	2/26/2018	9:35 AM	36.946158	-121.884252	9:39 AM	36.9483	-121.881167
113_3.RAW	2/26/2018	9:40 AM	36.946298	-121.883235	9:42 AM	36.94843	-121.879993
114_0944.RAW	2/26/2018	9:44 AM	36.945141	-121.883538	9:47 AM	36.94802	-121.879552
114_1.RAW	2/26/2018	9:49 AM	36.945262	-121.882467	9:53 AM	36.94751	-121.879273
114_2.RAW	2/26/2018	9:54 AM	36.944708	-121.882021	9:57 AM	36.94702	-121.878871
114_3.RAW	2/26/2018	9:58 AM	36.944253	-121.88161	10:01 AM	36.94672	-121.87824
115_1002.RAW	2/26/2018	10:02 AM	36.943741	-121.881394	10:05 AM	36.94649	-121.877496
115_1.RAW	2/26/2018	10:07 AM	36.9434	-121.880743	10:10 AM	36.94595	-121.877149
115_2.RAW	2/26/2018	10:11 AM	36.942986	-121.880271	10:14 AM	36.94561	-121.876643
115_3.RAW	2/26/2018	10:22 AM	36.94252	-121.879988	10:25 AM	36.94495	-121.876405
116_1026.RAW	2/26/2018	10:26 AM	36.941818	-121.879863	10:29 AM	36.94453	-121.875939
116_1.RAW	2/26/2018	10:30 AM	36.94144	-121.879301	10:33 AM	36.94406	-121.875585
116_2.RAW	2/26/2018	10:34 AM	36.941181	-121.878599	10:37 AM	36.94376	-121.875002
116_3.RAW	2/26/2018	10:38 AM	36.940687	-121.878269	10:41 AM	36.94319	-121.874719
117_1042.RAW	2/26/2018	10:42 AM	36.940209	-121.877778	10:45 AM	36.94209	-121.875169
118_1047.RAW	2/26/2018	10:47 AM	36.938015	-121.876671	10:50 AM	36.94054	-121.872934
119_1052.RAW	2/26/2018	10:52 AM	36.935894	-121.875591	10:55 AM	36.93935	-121.870599
120_1057.RAW	2/26/2018	10:57 AM	36.934133	-121.873871	11:00 AM	36.93736	-121.869236
121_1102.RAW	2/26/2018	11:02 AM	36.932478	-121.872761	11:06 AM	36.9355	-121.867791
122_1107.RAW	2/26/2018	11:07 AM	36.930758	-121.871727	11:11 AM	36.93316	-121.866634
123_1113.RAW	2/26/2018	11:13 AM	36.929341	-121.870685	11:17 AM	36.93208	-121.864383
124_1119.RAW	2/26/2018	11:19 AM	36.927636	-121.86848	11:22 AM	36.92953	-121.863883
125_1123.RAW	2/26/2018	11:23 AM	36.925735	-121.867036	11:27 AM	36.92824	-121.861376
126_1130.RAW	2/26/2018	11:30 AM	36.923778	-121.86573	11:34 AM	36.92581	-121.860611
059_0735.RAW	2/27/2018	7:35 AM	36.959204	-121.950241	7:41 AM	36.9661	-121.957587
061_0743.RAW	2/27/2018	7:43 AM	36.968387	-121.956095	7:46 AM	36.96445	-121.951776
61_1.RAW	2/27/2018	7:48 AM	36.965527	-121.952023	7:51 AM	36.96905	-121.955831
062_0751.RAW	2/27/2018	7:51 AM	36.969323	-121.955532	7:54 AM	36.96628	-121.952054
62_1.RAW	2/27/2018	7:55 AM	36.966842	-121.952125	7:58 AM	36.96987	-121.955213
063_0758.RAW	2/27/2018	7:58 AM	36.970156	-121.954886	8:00 AM	36.96788	-121.952595
63_1.RAW	2/27/2018	8:02 AM	36.968863	-121.953216	8:03 AM	36.97047	-121.954526
064_0804.RAW	2/27/2018	8:04 AM	36.970482	-121.954122	8:05 AM	36.96963	-121.95351
064_0805.RAW	2/27/2018	8:05 AM	36.969621	-121.953543	8:05 AM	36.97065	-121.9537
065_0814.RAW	2/27/2018	8:14 AM	36.95807	-121.950323	8:23 AM	36.97081	-121.953274
65_1.RAW	2/27/2018	8:23 AM	36.970799	-121.952927	8:27 AM	36.96445	-121.951422
066_0828.RAW	2/27/2018	8:28 AM	36.957683	-121.949414	8:37 AM	36.97085	-121.952365
66_1.RAW	2/27/2018	8:41 AM	36.970832	-121.951967	8:45 AM	36.96465	-121.950569
067_0855.RAW	2/27/2018	8:55 AM	36.958366	-121.948741	9:03 AM	36.97097	-121.951356
67_1.RAW	2/27/2018	9:03 AM	36.970964	-121.950928	9:07 AM	36.96469	-121.949627
068_0908.RAW	2/27/2018	9:08 AM	36.95856	-121.947928	9:15 AM	36.97104	-121.950363
68_1.RAW	2/27/2018	9:16 AM	36.97106	-121.95007	9:20 AM	36.96486	-121.948389

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69_1.RAW	2/27/2018	9:33 AM	36.970224	-121.948915	9:36 AM	36.9653	-121.946711
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070_0938.RAW	2/27/2018	9:38 AM	36.959688	-121.942822	9:47 AM	36.97173	-121.949038
060_0943.RAW	2/27/2018	9:43 AM	36.961995	-121.950944	9:44 AM	36.9636	-121.95277
70_1.RAW	2/27/2018	9:47 AM	36.972109	-121.948729	9:52 AM	36.965	-121.945209
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072_1005.RAW	2/27/2018	10:05 AM	36.972858	-121.94695	10:12 AM	36.96022	-121.939916
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195_0845.RAW	2/28/2018	8:41 AM	36.815029	-121.79714	8:43 AM	36.8159	-121.792811
196_1.RAW	2/28/2018	8:45 AM	36.813386	-121.796204	8:49 AM	36.81392	-121.792157
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182_0932.RAW	2/28/2018	9:32 AM	36.836236	-121.809177	9:35 AM	36.83768	-121.804504
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166_1016.RAW	2/28/2018	10:16 AM	36.849152	-121.817298	10:19 AM	36.85094	-121.811656
165_1209.RAW	2/28/2018	10:18 AM	36.848075	-121.81738	10:18 AM	36.84809	-121.817389
167_1018.RAW	2/28/2018	10:18 AM	36.848098	-121.817396	10:21 AM	36.84991	-121.811519
164_1021.RAW	2/28/2018	10:21 AM	36.850831	-121.817976	10:24 AM	36.85249	-121.813056
163_1220.RAW	2/28/2018	10:23 AM	36.849503	-121.818682	10:27 AM	36.85155	-121.812575
162_1029.RAW	2/28/2018	10:29 AM	36.852244	-121.819234	10:32 AM	36.85406	-121.813907
161_1223.RAW	2/28/2018	10:30 AM	36.851406	-121.819305	10:34 AM	36.85308	-121.813157
160_1034.RAW	2/28/2018	10:34 AM	36.856204	-121.821697	10:38 AM	36.85842	-121.815966
159_1226.RAW	2/28/2018	10:36 AM	36.854658	-121.820257	10:40 AM	36.85607	-121.814822
158_1039.RAW	2/28/2018	10:39 AM	36.860527	-121.823613	10:43 AM	36.86241	-121.818425
157_1229.RAW	2/28/2018	10:42 AM	36.857921	-121.823242	10:46 AM	36.85969	-121.817623
155_1232.RAW	2/28/2018	10:48 AM	36.862086	-121.825979	10:52 AM	36.86442	-121.819636
156_1050.RAW	2/28/2018	10:50 AM	36.864364	-121.826435	10:53 AM	36.86669	-121.821002
154_1055.RAW	2/28/2018	10:55 AM	36.868393	-121.829469	10:55 AM	36.86839	-121.829469
154_1055_0001.RAW	2/28/2018	10:55 AM	36.868391	-121.829443	10:58 AM	36.87016	-121.823363
153_1235.RAW	2/28/2018	10:56 AM	36.866145	-121.828586	11:00 AM	36.86827	-121.822115
152_1101.RAW	2/28/2018	11:01 AM	36.87228	-121.831884	11:04 AM	36.87449	-121.825529
151_1238.RAW	2/28/2018	11:02 AM	36.870432	-121.830429	11:06 AM	36.87247	-121.824404
150_1106.RAW	2/28/2018	11:06 AM	36.876448	-121.834098	11:10 AM	36.87849	-121.828165
149_1242.RAW	2/28/2018	11:08 AM	36.874103	-121.832858	11:11 AM	36.87656	-121.827052
148_1111.RAW	2/28/2018	11:11 AM	36.880907	-121.835436	11:14 AM	36.88255	-121.830844
147_1246.RAW	2/28/2018	11:13 AM	36.878304	-121.835178	11:16 AM	36.88054	-121.829778
146_1116.RAW	2/28/2018	11:16 AM	36.884504	-121.839115	11:19 AM	36.88695	-121.835183
145_3_0001.RAW	2/28/2018	11:18 AM	36.882554	-121.837229	11:21 AM	36.88456	-121.83217
144_3.RAW	2/28/2018	11:22 AM	36.887431	-121.839657	11:29 AM	36.88875	-121.837432
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144_2.RAW	2/28/2018	11:30 AM	36.888021	-121.839693	11:33 AM	36.88954	-121.835624
144_1.RAW	2/28/2018	11:34 AM	36.888407	-121.839982	11:38 AM	36.88962	-121.837196
145_1_0001.RAW	2/28/2018	11:34 AM	36.885915	-121.838859	11:39 AM	36.88718	-121.834591
144_1139.RAW	2/28/2018	11:39 AM	36.888682	-121.840816	11:42 AM	36.89054	-121.836366
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142_3.RAW	2/28/2018	11:45 AM	36.89121	-121.842022	11:48 AM	36.89278	-121.837901
142_2.RAW	2/28/2018	11:50 AM	36.891637	-121.842611	11:53 AM	36.89347	-121.838324
143_2_0001.RAW	2/28/2018	11:50 AM	36.889174	-121.841074	11:53 AM	36.89104	-121.837198
143_1_0001.RAW	2/28/2018	11:54 AM	36.889758	-121.841196	11:57 AM	36.89129	-121.838017
142_1.RAW	2/28/2018	11:56 AM	36.892311	-121.842386	11:58 AM	36.89381	-121.838767
141_1330.RAW	2/28/2018	11:58 AM	36.890095	-121.841679	12:01 PM	36.89183	-121.837365
142_1200.RAW	2/28/2018	12:00 PM	36.892514	-121.8434	12:02 PM	36.89439	-121.839044
140_1205.RAW	2/28/2018	12:05 PM	36.895703	-121.847975	12:08 PM	36.89805	-121.842131

143_1.RAW	2/28/2018	12:10 PM	36.889858	-121.843861	12:13 PM	36.89223	-121.837772
143_1212.RAW	2/28/2018	12:12 PM	36.890138	-121.843168	12:14 PM	36.89198	-121.838798
140_1333.RAW	2/28/2018	12:16 PM	36.893693	-121.846646	12:19 PM	36.89628	-121.840496
137_1341.RAW	2/28/2018	12:21 PM	36.897518	-121.849212	12:24 PM	36.90007	-121.84349
138_1225.RAW	2/28/2018	12:25 PM	36.899121	-121.851812	12:29 PM	36.90214	-121.844873
135_1356.RAW	2/28/2018	12:26 PM	36.901076	-121.852761	12:30 PM	36.90387	-121.846012
136_1231.RAW	2/28/2018	12:31 PM	36.904272	-121.851761	12:33 PM	36.90619	-121.847477
133_1239.RAW	2/28/2018	12:33 PM	36.9051	-121.855676	12:37 PM	36.90804	-121.848672
134_1235.RAW	2/28/2018	12:35 PM	36.907346	-121.856189	12:39 PM	36.91001	-121.849988
131_1402.RAW	2/28/2018	12:39 PM	36.908652	-121.858951	12:43 PM	36.91203	-121.8514
132_1241.RAW	2/28/2018	12:41 PM	36.911447	-121.858779	12:46 PM	36.91409	-121.85272
129_1407.RAW	2/28/2018	12:45 PM	36.912669	-121.861374	12:50 PM	36.91614	-121.853689
130_1248.RAW	2/28/2018	12:48 PM	36.915052	-121.862105	12:52 PM	36.91823	-121.855079
127_1412.RAW	2/28/2018	12:52 PM	36.917106	-121.863226	12:56 PM	36.9197	-121.857195
109_1316.RAW	2/28/2018	1:16 PM	36.951563	-121.89478	1:20 PM	36.95624	-121.889015
108_1318.RAW	2/28/2018	1:18 PM	36.952967	-121.897395	1:32 PM	36.95179	-121.901381
107_1323.RAW	2/28/2018	1:23 PM	36.959095	-121.89329	1:29 PM	36.95233	-121.902566
198_1.RAW	2/28/2018	1:51 PM	36.809214	-121.794645	1:53 PM	36.80954	-121.791326
010_0739.RAW	3/2/2018	7:39 AM	36.964203	-122.000766	7:39 AM	36.9642	-122.000766
009_1851.RAW	3/2/2018	7:40 AM	36.952402	-122.017151	7:46 AM	36.95749	-122.025169
009_1857.RAW	3/2/2018	7:47 AM	36.958255	-122.025412	7:50 AM	36.9553	-122.020707
011_1902.RAW	3/2/2018	7:52 AM	36.953759	-122.015663	7:58 AM	36.95964	-122.024799
119_1438.RAW	3/2/2018	7:58 AM	36.960061	-122.024515	8:01 AM	36.95718	-122.020119
010_0802.RAW	3/2/2018	8:02 AM	36.952798	-122.01598	8:08 AM	36.95892	-122.025458
012_0813.RAW	3/2/2018	8:13 AM	36.955196	-122.016229	8:19 AM	36.96052	-122.024406
014_0823.RAW	3/2/2018	8:23 AM	36.958159	-122.018027	8:26 AM	36.96174	-122.022956
013_0829.RAW	3/2/2018	8:29 AM	36.961043	-122.023651	8:34 AM	36.95644	-122.016552
016_0835.RAW	3/2/2018	8:35 AM	36.959844	-122.018802	8:38 AM	36.96252	-122.020744
015_0839.RAW	3/2/2018	8:39 AM	36.962116	-122.021875	8:39 AM	36.96187	-122.021755
017_0840.RAW	3/2/2018	8:40 AM	36.962532	-122.019428	8:42 AM	36.9597	-122.018504
018_0844.RAW	3/2/2018	8:44 AM	36.955743	-122.016501	8:47 AM	36.95902	-122.017183
017_0850.RAW	3/2/2018	8:50 AM	36.959637	-122.018339	8:50 AM	36.95964	-122.01834
017_0850_0001.RAW	3/2/2018	8:50 AM	36.959645	-122.018374	8:52 AM	36.96259	-122.019643
018_0853.RAW	3/2/2018	8:53 AM	36.96277	-122.018512	8:55 AM	36.95881	-122.017293
019_0859.RAW	3/2/2018	8:59 AM	36.95292	-122.014967	9:05 AM	36.96285	-122.017594
020_0906.RAW	3/2/2018	9:06 AM	36.963014	-122.016462	9:12 AM	36.95298	-122.014675
021_0912.RAW	3/2/2018	9:12 AM	36.95284	-122.014144	9:19 AM	36.96289	-122.015523
022_0920.RAW	3/2/2018	9:20 AM	36.962637	-122.014521	9:25 AM	36.95476	-122.013989
023_0925.RAW	3/2/2018	9:25 AM	36.954631	-122.013382	9:30 AM	36.96291	-122.013433
024_0932.RAW	3/2/2018	9:32 AM	36.9627	-122.012317	9:38 AM	36.95287	-122.012837
025_0938.RAW	3/2/2018	9:38 AM	36.952907	-122.012111	9:45 AM	36.96283	-122.011357
026_0945.RAW	3/2/2018	9:45 AM	36.962564	-122.010135	9:52 AM	36.95147	-122.011243
027_0953.RAW	3/2/2018	9:53 AM	36.952585	-122.009951	9:59 AM	36.96259	-122.009105
028_1000.RAW	3/2/2018	10:00 AM	36.96205	-122.007765	10:06 AM	36.95288	-122.00875
029_1013.RAW	3/2/2018	10:13 AM	36.953595	-122.007315	10:19 AM	36.96217	-122.006741
030_1021.RAW	3/2/2018	10:21 AM	36.961517	-122.005402	10:27 AM	36.95248	-122.006098
031_1028.RAW	3/2/2018	10:28 AM	36.952427	-122.004914	10:33 AM	36.96142	-122.004343
032_1035.RAW	3/2/2018	10:34 AM	36.96084	-122.003552	10:40 AM	36.95241	-122.003772
033_1041.RAW	3/2/2018	10:41 AM	36.952267	-122.002847	10:46 AM	36.96029	-122.002158
034_1047.RAW	3/2/2018	10:47 AM	36.961144	-122.001139	10:54 AM	36.95209	-122.001921

035_1054.RAW	3/2/2018	10:54 AM	36.95209	-122.001339	10:55 AM	36.95309	-122.001269
035_1056.RAW	3/2/2018	10:56 AM	36.95636	-122.000764	11:00 AM	36.96165	-121.999783
036_1100.RAW	3/2/2018	11:00 AM	36.961272	-121.998904	11:07 AM	36.95216	-122.001086
037_1107.RAW	3/2/2018	11:07 AM	36.952126	-122.00072	11:07 AM	36.95213	-122.00072
037_1107_0001.RAW	3/2/2018	11:07 AM	36.95215	-122.000719	11:14 AM	36.96125	-121.997915
038_1115.RAW	3/2/2018	11:15 AM	36.960693	-121.997011	11:21 AM	36.95208	-122.000266
039_1124.RAW	3/2/2018	11:24 AM	36.955913	-121.998185	11:27 AM	36.96035	-121.996276
040_1128.RAW	3/2/2018	11:28 AM	36.959776	-121.995671	11:34 AM	36.952	-121.999514
041_1135.RAW	3/2/2018	11:35 AM	36.951948	-121.998444	11:40 AM	36.95955	-121.994517
042_1141.RAW	3/2/2018	11:41 AM	36.959065	-121.993466	11:46 AM	36.95184	-121.997246
043_1147.RAW	3/2/2018	11:47 AM	36.951932	-121.996123	11:51 AM	36.95838	-121.992845
044_1152.RAW	3/2/2018	11:52 AM	36.958675	-121.991547	11:52 AM	36.95868	-121.991546
044_1152_0001.RAW	3/2/2018	11:52 AM	36.958701	-121.991541	11:57 AM	36.95145	-121.994517
045_1201.RAW	3/2/2018	12:01 PM	36.952128	-121.992841	12:06 PM	36.95988	-121.989821
046_1207.RAW	3/2/2018	12:07 PM	36.959635	-121.988258	12:11 PM	36.95524	-121.990406
047_1213.RAW	3/2/2018	12:13 PM	36.950692	-121.992114	12:20 PM	36.95956	-121.986339
048_1220.RAW	3/2/2018	12:20 PM	36.958782	-121.985155	12:27 PM	36.95031	-121.991009
049_1227.RAW	3/2/2018	12:27 PM	36.950296	-121.989952	12:35 PM	36.95813	-121.984096
050_1236.RAW	3/2/2018	12:36 PM	36.957555	-121.982504	12:43 PM	36.94947	-121.988855
051_1243.RAW	3/2/2018	12:43 PM	36.949114	-121.987292	12:49 PM	36.95674	-121.981365
052_1250.RAW	3/2/2018	12:50 PM	36.956394	-121.980566	12:57 PM	36.94862	-121.986401
053_1259.RAW	3/2/2018	12:59 PM	36.94857	-121.985117	1:04 PM	36.95568	-121.979395
054_1305.RAW	3/2/2018	1:05 PM	36.955191	-121.978645	1:07 PM	36.95352	-121.980066
054_1308.RAW	3/2/2018	1:08 PM	36.952628	-121.97971	1:12 PM	36.94792	-121.984476
055_1313.RAW	3/2/2018	1:13 PM	36.94792	-121.983278	1:19 PM	36.95475	-121.977945
199_0820.RAW	3/5/2018	10:01 AM	36.807819	-121.793773	10:05 AM	36.80743	-121.796079
200_1006.RAW	3/5/2018	10:06 AM	36.806586	-121.79636	10:09 AM	36.80709	-121.791146
197_2.RAW	3/5/2018	10:10 AM	36.810499	-121.796766	10:13 AM	36.8107	-121.794302
198_2_0001.RAW	3/5/2018	10:11 AM	36.808229	-121.796159	10:12 AM	36.80846	-121.793863
197_1_0001.RAW	3/5/2018	10:11 AM	36.811333	-121.794384	10:15 AM	36.81116	-121.796747
198_1_0001.RAW	3/5/2018	10:13 AM	36.809184	-121.794129	10:14 AM	36.80896	-121.796215
197_1.RAW	3/5/2018	10:13 AM	36.811812	-121.797361	10:17 AM	36.81216	-121.794681
198_1015.RAW	3/5/2018	10:15 AM	36.809717	-121.796225	10:16 AM	36.80995	-121.794057
195_1118.RAW	3/5/2018	10:16 AM	36.815153	-121.795874	10:20 AM	36.81452	-121.799194
196_2_0001.RAW	3/5/2018	10:17 AM	36.812498	-121.797761	10:19 AM	36.81282	-121.795079
195_1.RAW	3/5/2018	10:18 AM	36.815108	-121.800425	10:22 AM	36.81592	-121.797318
196_1_0001.RAW	3/5/2018	10:20 AM	36.813558	-121.795448	10:21 AM	36.81315	-121.798028
193_1124.RAW	3/5/2018	10:21 AM	36.817711	-121.798447	10:25 AM	36.81686	-121.8013
196_1021.RAW	3/5/2018	10:21 AM	36.813726	-121.798544	10:23 AM	36.81416	-121.796007
193_0850.RAW	3/5/2018	10:23 AM	36.818515	-121.803546	10:28 AM	36.81969	-121.800162
194_1_0001.RAW	3/5/2018	10:24 AM	36.81677	-121.79831	10:25 AM	36.81605	-121.800567
192_1026.RAW	3/5/2018	10:26 AM	36.820628	-121.804709	10:28 AM	36.82162	-121.801642
191_0856.RAW	3/5/2018	10:28 AM	36.823644	-121.802705	10:32 AM	36.82264	-121.805919
190_1029.RAW	3/5/2018	10:29 AM	36.825514	-121.80465	10:31 AM	36.82471	-121.807113
189_0902.RAW	3/5/2018	10:31 AM	36.826479	-121.808672	10:35 AM	36.82769	-121.805417
188_1032.RAW	3/5/2018	10:32 AM	36.828708	-121.809641	10:34 AM	36.82986	-121.806204
187_0912.RAW	3/5/2018	10:34 AM	36.832059	-121.80674	10:38 AM	36.83085	-121.810492
186_1035.RAW	3/5/2018	10:35 AM	36.832784	-121.80752	10:37 AM	36.83172	-121.810972
185_0918.RAW	3/5/2018	10:36 AM	36.832398	-121.811574	10:41 AM	36.83394	-121.807211
184_1039.RAW	3/5/2018	10:39 AM	36.833196	-121.812225	10:42 AM	36.83513	-121.806474

183_1144.RAW	3/5/2018	10:40 AM	36.835713	-121.804152	10:46 AM	36.83334	-121.81185
182_1043.RAW	3/5/2018	10:43 AM	36.836204	-121.809227	10:46 AM	36.83495	-121.812872
183_0927.RAW	3/5/2018	10:44 AM	36.834038	-121.812748	10:48 AM	36.83545	-121.808549
181_0935.RAW	3/5/2018	10:46 AM	36.836892	-121.809272	10:51 AM	36.83574	-121.813407
180_1047.RAW	3/5/2018	10:47 AM	36.83645	-121.814222	10:49 AM	36.838	-121.809645
179_0940.RAW	3/5/2018	10:49 AM	36.837316	-121.814496	10:54 AM	36.83889	-121.809891
178_1050.RAW	3/5/2018	10:50 AM	36.839654	-121.810594	10:52 AM	36.8382	-121.814913
177_0945.RAW	3/5/2018	10:52 AM	36.840349	-121.810691	10:56 AM	36.83905	-121.815226
176_1052.RAW	3/5/2018	10:52 AM	36.839786	-121.816047	10:55 AM	36.84138	-121.811166
175_0951.RAW	3/5/2018	10:55 AM	36.840552	-121.816517	11:00 AM	36.84223	-121.811557
174_1056.RAW	3/5/2018	10:56 AM	36.842977	-121.812343	10:58 AM	36.84148	-121.81673
173_1001.RAW	3/5/2018	10:58 AM	36.843828	-121.81228	11:03 AM	36.84233	-121.817095
172_1100.RAW	3/5/2018	11:00 AM	36.843031	-121.817915	11:03 AM	36.84495	-121.812208
171_1006.RAW	3/5/2018	11:01 AM	36.843784	-121.818282	11:06 AM	36.84538	-121.813805
170_1103.RAW	3/5/2018	11:03 AM	36.84633	-121.81399	11:06 AM	36.84471	-121.818777
144_1204.RAW	3/5/2018	11:04 AM	36.890735	-121.836481	11:11 AM	36.88711	-121.84523
169_1012.RAW	3/5/2018	11:04 AM	36.846985	-121.814503	11:08 AM	36.84557	-121.819061
168_1106.RAW	3/5/2018	11:06 AM	36.846059	-121.820379	11:09 AM	36.84775	-121.815512
167_1018_0001.RAW	3/5/2018	11:07 AM	36.84713	-121.820268	11:11 AM	36.84861	-121.815798
166_1109.RAW	3/5/2018	11:09 AM	36.849444	-121.816264	11:11 AM	36.848	-121.820516
165_1023.RAW	3/5/2018	11:09 AM	36.85026	-121.81666	11:14 AM	36.84883	-121.820972
164_1112.RAW	3/5/2018	11:12 AM	36.849525	-121.821784	11:14 AM	36.85086	-121.817867
162_1115.RAW	3/5/2018	11:15 AM	36.852391	-121.818876	11:17 AM	36.85128	-121.822486
160_1120.RAW	3/5/2018	11:20 AM	36.854949	-121.825043	11:23 AM	36.8565	-121.820929
163_1030.RAW	3/5/2018	11:20 AM	36.850304	-121.822308	11:25 AM	36.8517	-121.818264
161_1036.RAW	3/5/2018	11:23 AM	36.854603	-121.819625	11:27 AM	36.85332	-121.823637
158_1124.RAW	3/5/2018	11:24 AM	36.860461	-121.823613	11:26 AM	36.8591	-121.827089
159_1042.RAW	3/5/2018	11:26 AM	36.857113	-121.825864	11:31 AM	36.85858	-121.821902
157_1048.RAW	3/5/2018	11:29 AM	36.862429	-121.824364	11:34 AM	36.86121	-121.828111
156_1130.RAW	3/5/2018	11:30 AM	36.863097	-121.829618	11:32 AM	36.86463	-121.825658
155_1056.RAW	3/5/2018	11:32 AM	36.865209	-121.830746	11:37 AM	36.86668	-121.826845
154_1133.RAW	3/5/2018	11:33 AM	36.868678	-121.828243	11:35 AM	36.86729	-121.831764
153_1102.RAW	3/5/2018	11:35 AM	36.870783	-121.82906	11:40 AM	36.86929	-121.83304
152_1136.RAW	3/5/2018	11:36 AM	36.871231	-121.834606	11:38 AM	36.87283	-121.830369
151_1108.RAW	3/5/2018	11:38 AM	36.873154	-121.835943	11:43 AM	36.87487	-121.831495
150_1139.RAW	3/5/2018	11:39 AM	36.876912	-121.832773	11:41 AM	36.87522	-121.837162
149_1113.RAW	3/5/2018	11:42 AM	36.87888	-121.833633	11:47 AM	36.87725	-121.838359
148_1142.RAW	3/5/2018	11:42 AM	36.878971	-121.840081	11:45 AM	36.88106	-121.834933
147_1118.RAW	3/5/2018	11:46 AM	36.881028	-121.841298	11:51 AM	36.88301	-121.836285
146_1147.RAW	3/5/2018	11:47 AM	36.886522	-121.833817	11:52 AM	36.88309	-121.842712
145_3.RAW	3/5/2018	11:49 AM	36.885254	-121.838444	11:54 AM	36.88705	-121.833766
145_2.RAW	3/5/2018	11:53 AM	36.887393	-121.834178	11:57 AM	36.88586	-121.838685
144_3_0001.RAW	3/5/2018	11:54 AM	36.887476	-121.839575	11:57 AM	36.88899	-121.835276
145_1258.RAW	3/5/2018	11:55 AM	36.886234	-121.839197	12:00 PM	36.88802	-121.83453
133_1256.RAW	3/5/2018	11:56 AM	36.910562	-121.854856	12:01 PM	36.90766	-121.86154
144_2_0001.RAW	3/5/2018	11:58 AM	36.889432	-121.835722	12:00 PM	36.88787	-121.83995
145_1144.RAW	3/5/2018	11:58 AM	36.888422	-121.834872	12:05 PM	36.88512	-121.84386
144_1_0001.RAW	3/5/2018	12:00 PM	36.888412	-121.840445	12:03 PM	36.89001	-121.836005
143_3.RAW	3/5/2018	12:04 PM	36.88921	-121.841103	12:09 PM	36.89105	-121.836509
143_2.RAW	3/5/2018	12:08 PM	36.891421	-121.836797	12:12 PM	36.88982	-121.841167

142_3_0001.RAW	3/5/2018	12:10 PM	36.891195	-121.842147	12:13 PM	36.89311	-121.837885
143_1313.RAW	3/5/2018	12:10 PM	36.890222	-121.841626	12:15 PM	36.89201	-121.837019
142_2_0001.RAW	3/5/2018	12:13 PM	36.893398	-121.838332	12:16 PM	36.89169	-121.842435
143_1210.RAW	3/5/2018	12:13 PM	36.892378	-121.837432	12:20 PM	36.88882	-121.84645
142_1_0001.RAW	3/5/2018	12:16 PM	36.89206	-121.842979	12:19 PM	36.89404	-121.838424
141_1216.RAW	3/5/2018	12:30 PM	36.892338	-121.84966	12:35 PM	36.89482	-121.843962
142_1231.RAW	3/5/2018	12:31 PM	36.890684	-121.847621	12:36 PM	36.89445	-121.838931
139_1337.RAW	3/5/2018	12:33 PM	36.896741	-121.844994	12:38 PM	36.8943	-121.851029
139_1221.RAW	3/5/2018	12:37 PM	36.896094	-121.85273	12:42 PM	36.89874	-121.846732
138_1238.RAW	3/5/2018	12:38 PM	36.900741	-121.848216	12:41 PM	36.89809	-121.854132
137_1226.RAW	3/5/2018	12:41 PM	36.902556	-121.849239	12:46 PM	36.90004	-121.855529
136_1242.RAW	3/5/2018	12:42 PM	36.901829	-121.85729	12:45 PM	36.90438	-121.851417
134_1247.RAW	3/5/2018	12:47 PM	36.908508	-121.853823	12:50 PM	36.90582	-121.85997
132_1251.RAW	3/5/2018	12:51 PM	36.909567	-121.862988	12:55 PM	36.91253	-121.856286
135_1233.RAW	3/5/2018	12:56 PM	36.903922	-121.858574	1:01 PM	36.90666	-121.852198
130_1301.RAW	3/5/2018	1:01 PM	36.913486	-121.865789	1:05 PM	36.91654	-121.858778
131_1245.RAW	3/5/2018	1:02 PM	36.914748	-121.857118	1:08 PM	36.91165	-121.864124
129_1252.RAW	3/5/2018	1:07 PM	36.91547	-121.867159	1:13 PM	36.91885	-121.859404
128_1307.RAW	3/5/2018	1:07 PM	36.917474	-121.868333	1:13 PM	36.9223	-121.857186
125_1418.RAW	3/5/2018	1:12 PM	36.924104	-121.858373	1:19 PM	36.9194	-121.869859
126_1314.RAW	3/5/2018	1:14 PM	36.9247	-121.863536	1:18 PM	36.92137	-121.871308
123_1424.RAW	3/5/2018	1:18 PM	36.923164	-121.872957	1:25 PM	36.92683	-121.864655
124_1320.RAW	3/5/2018	1:20 PM	36.925243	-121.873987	1:23 PM	36.92865	-121.866292
121_1429.RAW	3/5/2018	1:24 PM	36.930567	-121.867501	1:30 PM	36.92738	-121.875079
122_1324.RAW	3/5/2018	1:24 PM	36.93213	-121.86931	1:28 PM	36.92845	-121.87598
120_1329.RAW	3/5/2018	1:29 PM	36.930904	-121.878259	1:33 PM	36.93553	-121.871787
119_1434.RAW	3/5/2018	1:34 PM	36.937252	-121.87345	1:40 PM	36.93312	-121.879466
118_1334.RAW	3/5/2018	1:34 PM	36.938884	-121.875387	1:38 PM	36.93524	-121.880694
117_1439.RAW	3/5/2018	1:39 PM	36.936488	-121.883232	1:47 PM	36.94316	-121.873735
116_1342.RAW	3/5/2018	1:42 PM	36.938118	-121.885148	1:48 PM	36.94474	-121.87572
115_1446.RAW	3/5/2018	1:46 PM	36.946457	-121.877192	1:54 PM	36.93947	-121.887441
114_1349.RAW	3/5/2018	1:49 PM	36.94803	-121.879231	1:56 PM	36.94077	-121.889893
113_1454.RAW	3/5/2018	1:54 PM	36.942013	-121.892428	2:03 PM	36.95001	-121.881016
112_1358.RAW	3/5/2018	1:58 PM	36.943413	-121.894611	2:03 PM	36.94917	-121.886473
111_1503.RAW	3/5/2018	2:03 PM	36.951034	-121.888073	2:12 PM	36.94467	-121.897166
110_1405.RAW	3/5/2018	2:05 PM	36.952426	-121.890151	2:11 PM	36.94609	-121.898945
108_1412.RAW	3/5/2018	2:12 PM	36.948791	-121.902599	2:18 PM	36.95556	-121.893939
106_1419.RAW	3/5/2018	2:19 PM	36.958752	-121.897947	2:25 PM	36.95154	-121.906869
104_1426.RAW	3/5/2018	2:26 PM	36.952771	-121.909155	2:33 PM	36.96384	-121.899182
11_1.RAW	3/5/2018	2:29 PM	36.929728	-121.877219	2:33 PM	36.93391	-121.870404
103_1438.RAW	3/5/2018	2:38 PM	36.965208	-121.901305	2:45 PM	36.95327	-121.910262
097_1447.RAW	3/5/2018	2:47 PM	36.955956	-121.916094	2:55 PM	36.96822	-121.90695
109_1511.RAW	3/5/2018	3:11 PM	36.947079	-121.900931	3:16 PM	36.954	-121.891984
107_1518.RAW	3/5/2018	3:18 PM	36.957134	-121.895687	3:24 PM	36.95065	-121.904839
105_1524.RAW	3/5/2018	3:24 PM	36.952219	-121.90824	3:33 PM	36.96135	-121.899089

Appendix A: Weather Observation Forms

Marine Environmental Variables Form

Dates: 2/26/2018 -3/5/2018

Date	Time	Latitude	Longitude	Vessel Activity	Weather	Cloud Cover	Glare	Visibility	Wind Speed	Sea State	Swell Height	Monitors
2/26	10:52 am	36.938497°	-121.871953°	Survey	Overcast	Overcast	None	5+ nm	Light	Calm	3-4 ft	Monitor: S. Harrison, T. Elfers
2/27	10:20 am	36.971228°	-121.944488°	Survey	Clear	None	Moderate	5+ nm	0-10 knots	Calm	1-2 ft	P. Limber, R. Marcuson
2/28	11:44 am	36.888134°	-121.836286°	Survey	Overcast	Overcast	None	5+ nm	Light	Calm	2-3+ ft	J. Koster, A. Stevens, A. Snyder
3/2	8:29 am	36.958749°	-122.020066°	Survey	Overcast	Overcast	None	5+ nm	10-20 knots	Choppy	3-4 feet ft	S. Harrison, A. Snyder
3/5	10:39 am	36.834390°	-121.808749°	Survey	Clear	None	Moderate	5+ nm	0-10 knots	Calm	1-2 ft	J. Logan, A. Stevens

Appendix B: Marine Wildlife Observations

Marine Wildlife Observations Form

Date: 2/26/2018 Monitor: S. Harrison, T. Elfers

Time: 10:52 am	Latitude: 36.938497°	Longitude: -121.871953°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 3-4 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		

Marine Wildlife Observations Form

Date: 2/27/2018 Monitor: P. Limber, R. Marcuson

Time: 10:20 am	Latitude: 36.971228°	Longitude: -121.944488°
Weather: Sunny/Clear	Cloud Cover: None	Glare: Moderate
Visibility: 5+ nm	Wind Speed: 0-10 knots	Sea State: calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Time: 10:20 am	Latitude: 36.972420°	Longitude: -121.928785°
Weather: Sunny/Clear	Cloud Cover: None	Glare: Moderate
Visibility: 5+ nm	Wind Speed: 0-10 knots	Sea State: calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		

Marine Wildlife Observations Form

Date: 2/28/2018 Monitor: A. Stevens, J. Koster, A. Snyder

Time11:44 am	Latitude: 36.888134°	Longitude: -121.836286°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 2-3+ feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		

Marine Wildlife Observations Form

Date: 3/2/2018 Monitor: S. Harrison, A. Snyder

Time: 8:29 am	Latitude: 36.958749°	Longitude: -122.020066°
Weather: Overcast	Cloud Cover: Overcast	Glare: None
Visibility: 5+ nm	Wind Speed: 10-20 knots	Sea State: choppy
Swell Height: 3-4 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		

Marine Wildlife Observations Form

Date: 3/5/2018 Monitor: A. Stevens, J. Logan

Time: 10:39 am	Latitude: 36.834390°	Longitude: -121.808749°
Weather: Clear	Cloud Cover: None	Glare: Moderate
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		
Time: 2:24 pm	Latitude: 36.932867°	Longitude: -121.872158°
Weather: Clear	Cloud Cover: None	Glare: Moderate
Visibility: 5+ nm	Wind Speed: Light	Sea State: calm
Swell Height: 1-2 feet	Survey Vessel Activity: Survey	
Marine Wildlife Observations and Interactions:		

Appendix C: Exhibit H

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
Air Quality and Greenhouse Gas (GHG) Emissions (MND Section 3.3.3)						
MM AIR-1: Engine Tuning, Engine Certification, and Fuels. The following measures will be required to be implemented by all Permittees under the Offshore Geophysical Permit Program (OGPP), as applicable depending on the county offshore which a survey is being conducted. Pursuant to section 93118.5 of CARB's Airborne Toxic Control Measures, the Tier 2 engine requirement applies only to diesel-fueled vessels.	All Counties: Maintain all construction equipment in proper tune according to manufacturers' specifications; fuel all off-road and portable diesel-powered equipment with California Air Resources Board (CARB)-certified motor vehicle diesel fuel limiting sulfur content to 15 parts per million or less (CARB Diesel).	Daily emissions of criteria pollutants during survey activities are minimized.	Determine engine certification of vessel engines. Review engine emissions data to assess compliance, determine if changes in tuning or fuel are required.	OGPP permit holder and contract vessel operator; California State Lands Commission (CSLC) review of Final Monitoring Report.	Prior to, during, and after survey activities. Submit Final Monitoring Report after completion of survey activities.	
	Los Angeles and Orange Counties: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner; the survey shall be operated such that daily NO_x emissions do not exceed 100 pounds based on engine certification emission factors. This can be accomplished with Tier 2 engines if daily fuel use is 585 gallons or less, and with Tier 3 engines if daily fuel use is 935 gallons or less.		Verify that Tier 2 or cleaner engines are being used. Calculate daily NO_x emissions to verify compliance with limitations.			
	San Luis Obispo County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 585 gallons or less; all diesel equipment shall not idle for more than 5 minutes; engine use needed to maintain position in the water is not considered idling; diesel idling within 300 meters (1,000 feet) of sensitive receptors is not permitted; use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Verify that Tier 2 or cleaner engines are being used. Inform vessel operator(s) of idling limitation. Investigate availability of alternative fuels.			
	Santa Barbara County: Use vessel engines meeting CARB's Tier 2-certified engines or cleaner, accomplished with Tier 2 engines if daily fuel use is 790 gallons or less.		Verify that Tier 2 or cleaner engines are being used. Investigate availability of alternative fuels.			2/5 TE
	Ventura County: Use alternatively fueled construction equipment on site where feasible, such as compressed natural gas, liquefied natural gas, propane or biodiesel.		Investigate availability of alternative fuels.			

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-1: Marine Mammal and Sea Turtle Presence – Current Information.	All State waters; prior to commencement of survey operations, the geophysical operator shall: (1) contact the National Oceanic and Atmospheric Administration Long Beach office staff and local whale-watching operations and shall acquire information on the current composition and relative abundance of marine wildlife offshore, and (2) convey sightings data to the vessel operator and crew, survey party chief, and onboard Marine Wildlife Monitors (MWMs) prior to departure. This information will aid the MWMs by providing data on the approximate number and types of organisms that may be in the area.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document contact with appropriate sources. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; Inquiry to NOAA and local whale watching operators.	Prior to survey.	2/5 TC
MM BIO-2: Marine Wildlife Monitors (MWMs).	Except as provided in section 7(h) of the General Permit, a minimum of two (2) qualified MWMs who are experienced in marine wildlife observations shall be onboard the survey vessel throughout both transit and data collection activities. The specific monitoring, observation, and data collection responsibilities shall be identified in the Marine Wildlife Contingency Plan required as part of all Offshore Geophysical Permit Program permits. Qualifications of proposed MWMs shall be submitted to the National Oceanic and Atmospheric Administration (NOAA) and CSLC at least twenty-one (21) days in advance of the survey for their approval by the agencies. Survey operations shall not commence until the CSLC approves the MWMs.	Competent and professional monitoring or marine mammals and sea turtles; compliance with established monitoring policies.	Document contact with and approval by appropriate agencies. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	2/5 TC
MM BIO-3: Safety Zone Monitoring.	Onboard Marine Wildlife Monitors (MWMs) responsible for observations during vessel transit shall be responsible for monitoring during the survey equipment operations. All visual monitoring shall occur from the highest practical vantage point aboard the survey vessel; binoculars shall be used to observe the surrounding area, as appropriate. The MWMs will survey an area (i.e., safety or exclusion zone) based on the equipment used, centered on the sound source (i.e., vessel, towfish), throughout time that the survey equipment is operating. Safety zone radial distances, by equipment type, include:	No adverse effects to marine mammals or sea turtles due to survey activities are observed; compliance with established safety zones.	Compliance with permit requirements (observers); compliance with established safety zones. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	2/5 TC

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials

Equipment Type	Safety Zone (radius, m)
Single Beam Echosounder	50
Multibeam Echosounder	500
Side-Scan Sonar	600
Subbottom Profiler	100
Boomer System	100

If the geophysical survey equipment is operated at or above a frequency of 200 kilohertz (kHz), safety zone monitoring and enforcement is not required; however, if geophysical survey equipment operated at a frequency at or above 200 kHz is used simultaneously with geophysical survey equipment less than 200 kHz, then the safety zone for the equipment less than 200 kHz must be monitored. The onboard MWMs shall have authority to stop operations if a mammal or turtle is observed within the specified safety zone and may be negatively affected by survey activities. The MWMs shall also have authority to recommend continuation (or cessation) of operations during periods of limited visibility (i.e., fog, rain) based on the observed abundance of marine wildlife. Periodic reevaluation of weather conditions and reassessment of the continuation/cessation recommendation shall be completed by the onboard MWMs. During operations, if an animal's actions are observed to be irregular, the monitor shall have authority to recommend that equipment be shut down until the animal moves further away from the sound source. If irregular behavior is observed, the equipment shall be shut-off and will be restarted and ramped-up to full power, as applicable, or will not be started until the animal(s) is/are outside of the safety zone or have not been observed for 15 minutes.

For nearshore survey operations utilizing vessels that lack the personnel capacity to hold two (2) MWMs aboard during survey operations, at least twenty-one (21) days prior to the commencement of survey activities, the Permittee may petition the CSLC to conduct survey operations with one (1) MWM aboard. The CSLC will consider such authorization on a case-by-case basis and

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Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
	factors the CSLC will consider will include the timing, type, and location of the survey, the size of the vessel, and the availability of alternate vessels for conducting the proposed survey. CSLC authorizations under this subsection will be limited to individual surveys and under any such authorization; the Permittee shall update the MWCP to reflect how survey operations will occur under the authorization.					
MM BIO-4: Limits on Nighttime OGPP Surveys.	All State waters; nighttime survey operations are prohibited under the OGPP, except as provided below. The CSLC will consider the use of single beam echosounders and passive equipment types at night on a case-by-case basis, taking into consideration the equipment specifications, location, timing, and duration of survey activity.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Presurvey request for nighttime operations, including equipment specifications and proposed use schedule. Document equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Approval required before survey is initiated. Monitoring Report following comple-tion of survey.	2/5 TC
MM BIO-5: Soft Start.	All State waters; the survey operator shall use a "soft start" technique at the beginning of survey activities each day (or following a shut down) to allow any marine mammal that may be in the immediate area to leave before the sound sources reach full energy. Surveys shall not commence at nighttime or when the safety zone cannot be effectively monitored. Operators shall initiate each piece of equipment at the lowest practical sound level, increasing output in such a manner as to increase in steps not exceeding approximately 6 decibels (dB) per 5-minute period. During ramp-up, the Marine Wildlife Monitors (MWMs) shall monitor the safety zone. If marine mammals are sighted within or about to enter the safety zone, a power-down or shut down shall be implemented as though the equipment was operating at full power. Initiation of ramp-up procedures from shut down requires that the MWMs be able to visually observe the full safety zone.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Compliance with permit requirements (observers); compliance with safe start procedures. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to survey.	2/26 TC

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-6: Practical Limitations on Equipment Use and Adherence to Equipment Manufacturer's Routine Maintenance Schedule.	All State waters; geophysical operators shall follow, to the maximum extent possible, the guidelines of Zykov (2013) as they pertain to the use of subbottom profilers and side-scan sonar, including: • Using the highest frequency band possible for the subbottom profiler; • Using the shortest possible pulse length; and • Lowering the pulse rate (pings per second) as much as feasible. Geophysical operators shall consider the potential applicability of these measures to other equipment types (e.g., boomer). Permit holders will conduct routine inspection and maintenance of acoustic-generating equipment to ensure that low energy geophysical equipment used during permitted survey activities remains in proper working order and within manufacturer's equipment specifications. Verification of the date and occurrence of such equipment inspection and maintenance shall be provided in the required presurvey notification to CSLC.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Document initial and during survey equipment settings. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Immediately prior to and during survey.	2/24 TL
MM BIO-7: Avoidance of Pinniped Haul-Out Sites.	The Marine Wildlife Contingency Plan (MWCP) developed and implemented for each survey shall include identification of haul-out sites within or immediately adjacent to the proposed survey area. For surveys within 300 meters (m) of a haul-out site, the MWCP shall further require that: • The survey vessel shall not approach within 91 m of a haul-out site, consistent with National Marine Fisheries Service (NMFS) guidelines; • Survey activity close to haul-out sites shall be conducted in an expedited manner to minimize the potential for disturbance of pinnipeds on land; and • Marine Wildlife Monitors shall monitor pinniped activity onshore as the vessel approaches, observing and reporting on the number of pinnipeds potentially disturbed (e.g., via head lifting, flushing into the water). The purpose of such reporting is to provide CSLC and California Department of Fish and Wildlife (CDFW) with information regarding potential disturbance associated with OGPP surveys.	No adverse effects to pinnipeds at haul outs are observed.	Document pinniped reactions to vessel presence and equipment use. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following completion of survey.	3/5 TL

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-8: Reporting Requirements – Collision.	All State waters; if a collision with marine mammal or reptile occurs, the vessel operator shall document the conditions under which the accident occurred, including the following: • Vessel location (latitude, longitude) when the collision occurred; • Date and time of collision; • Speed and heading of the vessel at the time of collision; • Observation conditions (e.g., wind speed and direction, swell height, visibility in miles or kilometers, and presence of rain or fog) at the time of collision; • Species of marine wildlife contacted (if known); • Whether an observer was monitoring marine wildlife at the time of collision; and, • Name of vessel, vessel owner/operator, and captain officer in charge of the vessel at time of collision. After a collision, the vessel shall stop, if safe to do so; however, the vessel is not obligated to stand by and may proceed after confirming that it will not further damage the animal by doing so. The vessel will then immediately communicate by radio or telephone all details to the vessel's base of operations, and shall immediately report the incident. Consistent with Marine Mammal Protection Act requirements, the vessel's base of operations or, if an onboard telephone is available, the vessel captain him/herself, will then immediately call the National Oceanic and Atmospheric Administration (NOAA) Stranding Coordinator to report the collision and follow any subsequent instructions. From the report, the Stranding Coordinator will coordinate subsequent action, including enlisting the aid of marine mammal rescue organizations, if appropriate. From the vessel's base of operations, a telephone call will be placed to the Stranding Coordinator, NOAA National Marine Fisheries Service (NMFS), Southwest Region, Long Beach, to obtain instructions. Although NOAA has primary responsibility for marine mammals in both State and Federal waters, the California Department of Fish and Wildlife (CDFW) will also be advised that an incident has occurred in State waters affecting a protected species.	No adverse effects to marine mammals or sea turtles due to survey activities are observed.	Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Monitoring Report following comple-tion of survey.	3/5 TZ

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM BIO-9: Limitations on Survey Operations in Select Marine Protected Areas (MPAs).	All MPAs; prior to commencing survey activities, geophysical operators shall coordinate with the CLSC, California Department of Fish and Wildlife (CDFW), and any other appropriate permitting agency regarding proposed operations within MPAs. The scope and purpose of each survey proposed within a MPA shall be defined by the permit holder, and the applicability of the survey to the allowable MPA activities shall be delineated by the permit holder. If deemed necessary by CDFW, geophysical operators will pursue a scientific collecting permit, or other appropriate authorization, to secure approval to work within a MPA, and shall provide a copy of such authorization to the CSLC as part of the required presurvey notification to CSLC. CSLC, CDFW, and/or other permitting agencies may impose further restrictions on survey activities as conditions of approval.	No adverse effects to MPA resources due to survey activities are observed.	Monitor reactions of wildlife to survey operations; report on shutdown conditions and survey restart. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder; survey permitted by CDFW.	Prior to survey.	2/5 TC
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Permittees shall develop and submit to CSLC staff for review and approval an OSCP that addresses accidental releases of petroleum and/or non-petroleum products during survey operations. Permittees' OSCPs shall include the following information for each vessel to be involved with the survey: • Specific steps to be taken in the event of a spill, including notification names, phone numbers, and locations of: (1) nearby emergency medical facilities, and (2) wildlife rescue/response organizations (e.g., Oiled Wildlife Care Network); • Description of crew training and equipment testing procedures; and • Description, quantities, and location of spill response equipment onboard the vessel.	Reduction in the potential for an accidental spill. Proper and timely response and notification of responsible parties in the event of a spill.	Documentation of proper spill training. Notification of responsible parties in the event of a spill.	OGPP permit holder and contract vessel operator.	Prior to survey.	2/5 TC
MM HAZ-2: Vessel fueling restrictions.	Vessel fueling shall only occur at an approved docking facility. No cross vessel fueling shall be allowed.	Reduction in the potential for an accidental spill.	Documentation of fueling activities.	Contract vessel operator.	Following survey.	
MM HAZ-3: OSCP equipment and supplies.	Onboard spill response equipment and supplies shall be sufficient to contain and recover the worst-case scenario spill of petroleum products as outlined in the OSCP.	Proper and timely response in the event of a spill.	Notification to CSLC of onboard spill response equipment/supplies inventory, verify	Contract vessel operator.	Prior to survey.	

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
			ability to respond to worst-case spill.			
MM HAZ-1: Oil Spill Contingency Plan (OSCP) Required Information.	Outlined under **Hazards and Hazardous Materials** (above)					
MM HAZ-2: Vessel fueling restrictions.	Outlined under **Hazards and Hazardous Materials** (above)					
MM HAZ-3: OSCP equipment and supplies.	Outlined under **Hazards and Hazardous Materials** (above)					
MM BIO-9: Limitations on Survey Operations in Select MPAs.	Outlined under **Biological Resources** (above)					
MM REC-1: U.S. Coast Guard (USCG), Harbormaster, and Dive Shop Operator Notification.	All California waters where recreational diving may occur; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to divers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall: (1) post such notices in the harbormasters' offices of regional harbors; and (2) notify operators of dive shops in coastal locations adjacent to the proposed offshore survey operations.	No adverse effects to recreational divers from survey operations.	Notify the USCG, local harbormasters, and local dive shops of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	2/5 TZ

Mitigation Measure (MM)	Location and Scope of Mitigation	Effectiveness Criteria	Monitoring or Reporting Action	Responsible Party	Timing	Implementation Date(s) and Initials
MM FISH-1: U.S. Coast Guard (USCG) and Harbormaster Notification.	All California waters; as a survey permit condition, the CSLC shall require Permittees to provide the USCG with survey details, including information on vessel types, survey locations, times, contact information, and other details of activities that may pose a hazard to mariners and fishers so that USCG can include the information in the Local Notice to Mariners, advising vessels to avoid potential hazards near survey areas. Furthermore, at least twenty-one (21) days in advance of in-water activities, Permittees shall post such notices in the harbormasters' offices of regional harbors.	No adverse effects to commercial fishing gear in place.	Notify the USCG and local harbormasters of planned survey activity. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Prior to survey.	2/5 TZ
MM FISH-2: Minimize Interaction with Fishing Gear.	To minimize interaction with fishing gear that may be present within a survey area: (1) the geophysical vessel (or designated vessel) shall traverse the proposed survey corridor prior to commencing survey operations to note and record the presence, type, and location of deployed fishing gear (i.e., buoys); (2) no survey lines within 30 m (100 feet) of observed fishing gear shall be conducted. The survey crew shall not remove or relocate any fishing gear; removal or relocation shall only be accomplished by the owner of the gear upon notification by the survey operator of the potential conflict.	No adverse effects to commercial fishing gear in place.	Visually observe the survey area for commercial fishing gear. Notify the gear owner and request relocation of gear outside survey area. Submit Final Monitoring Report after completion of survey activities.	OGPP permit holder.	Imme-diately prior to survey (prior to each survey day).	2/26 TZ
MM FISH-1: USCG and Harbormaster Notification.	Outlined under **Commercial and Recreational Fisheries** (above)					

Acronyms/Abbreviations: CARB = California Air Resources Board; CDFW = California Department of Fish and Wildlife; CSLC = California State Lands Commission; dB = decibels; kHz = kilohertz; MPA = Marine Protected Area; MWCP = Marine Wildlife Contingency Plan; MWM = Marine Wildlife Monitor; m= meter(s); NOAA = National Oceanic and Atmospheric Administration; NO_x = Nitrogen Oxide; OGPP = Offshore Geophysical Permit Program; OSCP = Oil Spill Contingency Plan; USCG = U.S. Coast Guard